10. Maps: Visual Representation of Data by Location

Introduction

Epi Info™ 7 Maps is a versatile tool that geographically displays data on a map. The Maps tool has the ability to display multiple views from the same dataset. Datasets can be filtered or shown over a series of time using features in the Maps tool. Users can tailor these features to create a customized map containing public health data.

Information displayed in the main map window appears in the form of layers. Data layers exist in the form of case clusters, choropleth maps, or dot density maps. Reference layers add geographical boundaries and markers from shape files, a map server, or KML files. This format allows the Maps tool to uniquely identify and designate display settings from both internal and external data sources. Users may modify or filter map data using the data layers gadget located at the bottom of the main map window

Basic Tools

To open Maps, click **Create Maps** from the Epi Info™ 7 main menu, or select **Tools > Create Maps** from the main page navigation menu. Maps can also be accessed from the navigation menu at the top of the Enter screen. This section of the user guide provides instructions on how to use the Maps tool when accessed from the main menu. Accessing the Maps tool from the Enter navigation menu enables additional interactivity between the project data and the mapping tool. For additional information regarding the Maps tool's functionality from the Enter Data tool, refer to the Enter Data section of this user guide.

Figure 10.1: Main Map window

View Settings

The default setting in the main window is satellite view. The satellite view displays national boundaries, major roadways and geographic markings along with the region's topography. To change the view setting, click on the **Street** or **Blank** radio button at the top right corner of the screen. The street view displays similar geographic landmarks, roadways and boundaries without the region's topography. The blank view displays an empty canvas, which is beneficial when working with custom boundary files or adding reference layers (See Reference Layers).

Navigation Tools

To zoom in and out on a location, place the mouse over the desired location and rotate the mouse wheel forwards or backwards respectively. You can also zoom in or out by using the navigation panel at the top left corner of the screen. Click the **+** to zoom in or the – to zoom out. The navigation panel also allows you to click and drag the bar located in between the + and –to adjust the view. Directly to the right of the zoom option is a compass. Clicking on the arrows representing north, south, east and west will move the map location in the selected direction. You can also click and drag the map to adjust the screen. To rotate the view, click and drag the compass wheel until the map view meets your specifications.

Basic Functions

The map window contains the following tools to help create a meaningful representation of your data:

1. Add marker
2. Add zone
3. Add label
4. Remove all layers

Access each of these basic functions from the main map window.

Add Marker

A marker identifies a point of interest by placing a symbol on the map. Symbols are available in various shapes and sizes to identify multiple points of interest.

1. Right click on the **main map window** in the location where you would like to place the marker. A menu appears displaying the available options.
2. Select **Add marker.**

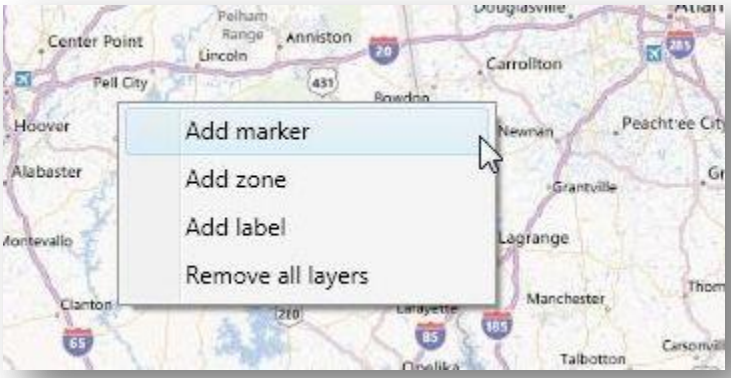

Figure 10.2: Basic Tools option

3. Select a **Style** from the Style drop-down list for the marker. The style will determine the marker's shape on the screen.

Figure 10.3: Marker styles

4. Select the **Size** of the marker from the Size drop-down list.
5. Select the **Color** of the marker by clicking on the red **Point Color** button to the right of the dialog box.

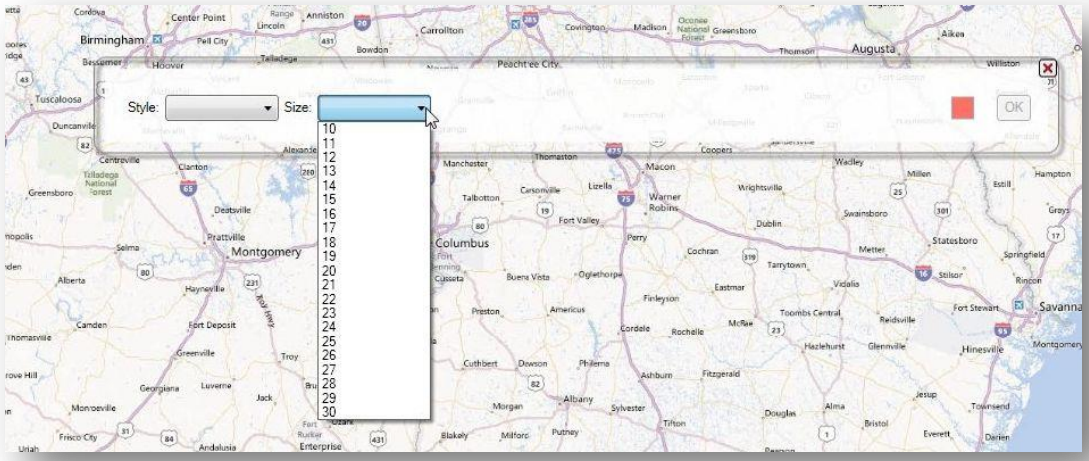

Figure 10.4: Marker size

6. Click **OK**.

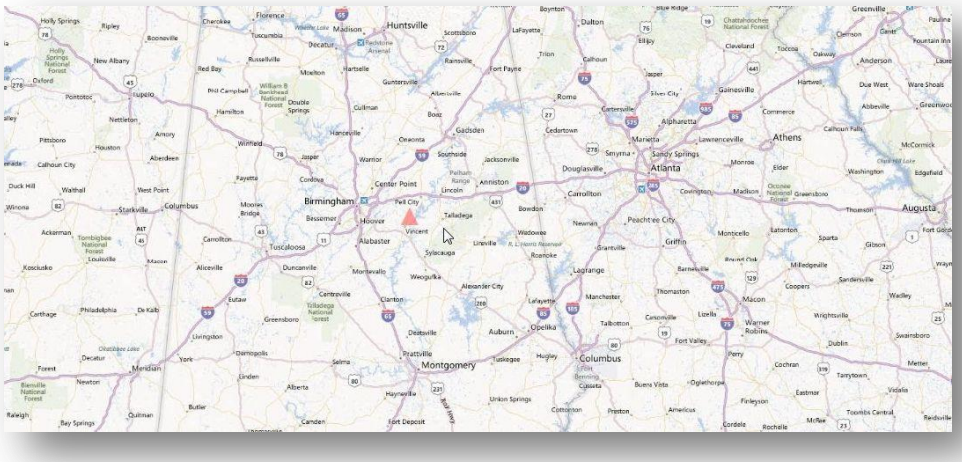

Figure 10.5: Marker displayed in Map window

Add Zone

A zone identifies a circular region on the map. This is useful when highlighting an area that centers on a point of interest or specifying an area with public health implications.

1. Right click on the main map window in the location where you would like to place the center of the zone.
2. Select **Add zone**.

3. Enter the desired **Radius**, **Units** and **Color**. Zones can be of varied size and color but are limited to a circular shape.

Figure 10.6: Zone settings

4. Click **OK**.

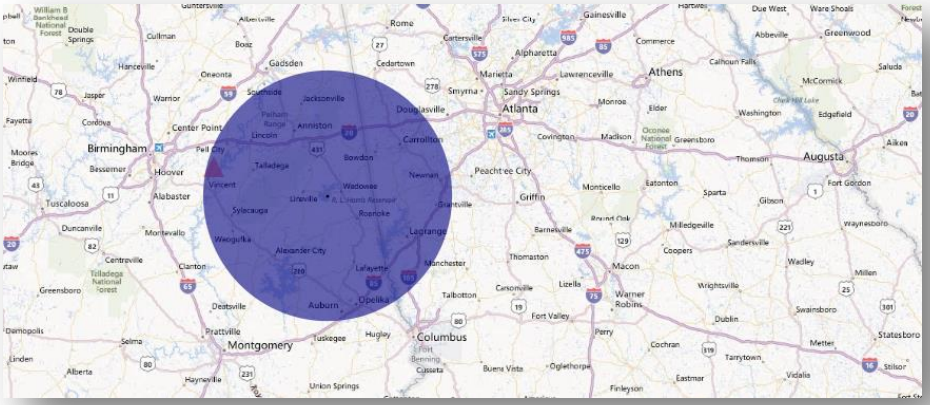

Figure 10.7: Zone displayed in map window

Note: Zones will appear distorted when placed closer to the north and south poles due to the area being re-projected from the globe onto a flat surface.

Add Label

1. Right click on the **main map window** in the location where you would like to place the label.
2. Select **Add label**.
3. Enter the label you would like to display in the textbox. Click the **ellipses** next to the **Font** textbox to select the desired **Font** and **Color**.

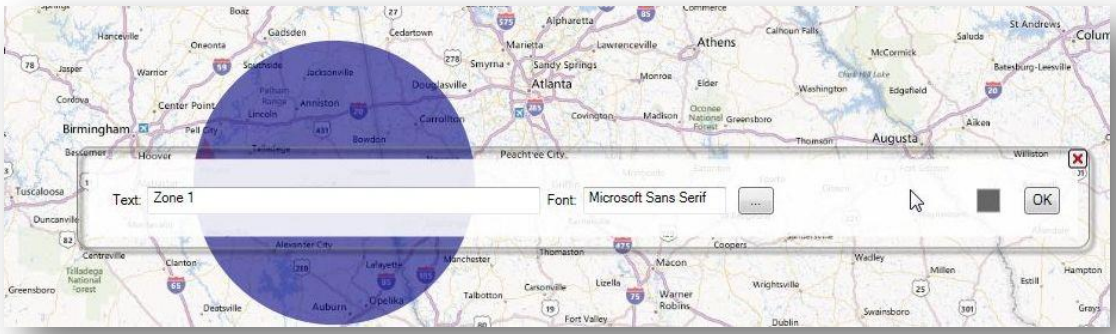

Figure 10.8: Label Settings

4. Click **OK**.

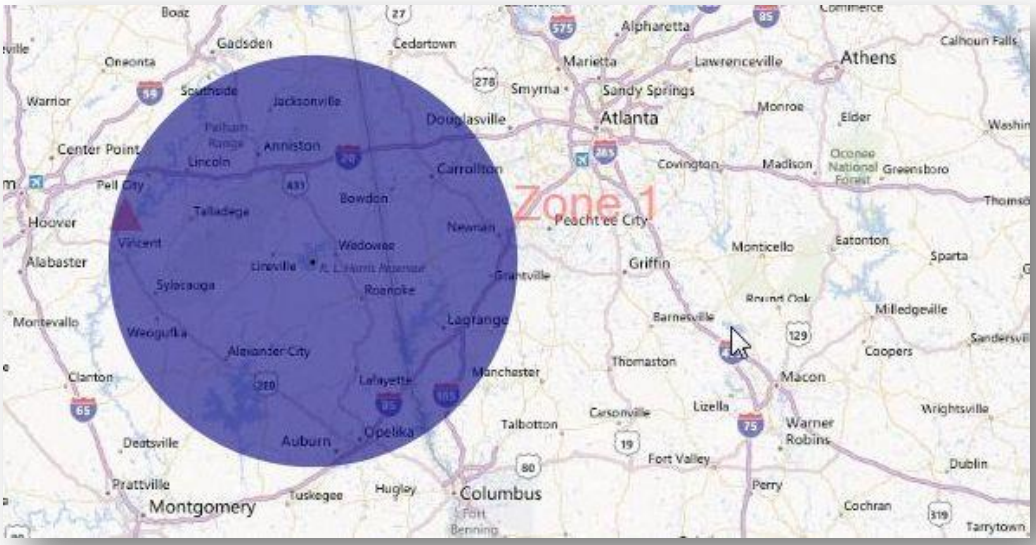

Figure 10.9: Label displayed in Map window

Remove All Layers

To clear the main map window of all layers, right click on the map and select **Remove all layers.**

Save Maps as Map File

Maps may be saved as either an image file (*.png) or an Epi Info™ 7 Map File (*.map7). The map file format saves the map along with the underlying data layers. The Epi Info™ 7 Map File can only be opened using the Epi Info™ 7 software. When opened, the map file will automatically update the map based on any changes to the dataset. Create and save the map file by clicking on the **Save** button in the Maps toolbar.

1. Click the **Save** button. A **Save As** dialog box opens.

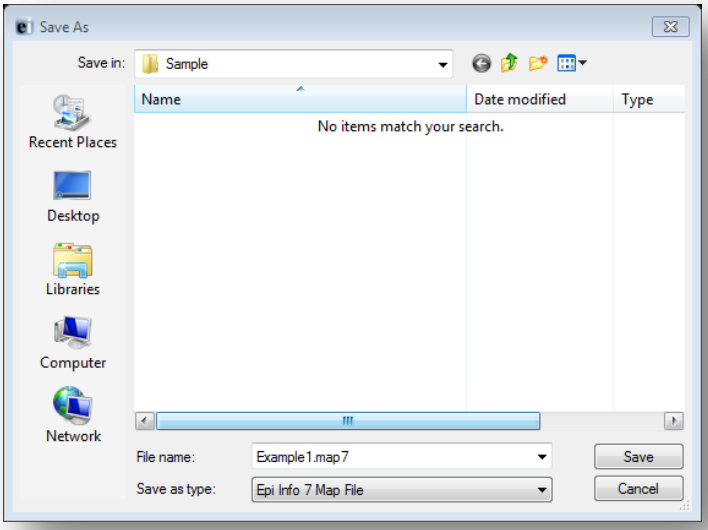

Figure 10.10: Save As dialog box

2. Create a **File name** and choose a file destination from the **Save in** drop-down list. The map is saved in the *.map7 file format, which can be opened later by Epi Info™.
3. Click the **Save** button. A **Save Successful** dialog box appears.

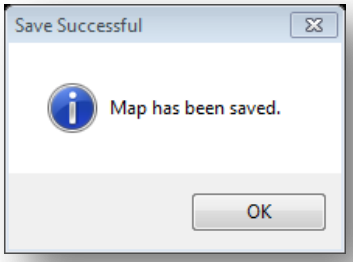

Figure 10.11: Save Successful

4. Click **OK** to exit.

Save Maps as an Image

The image format saves only the map image in a *.png file format. This image file can be inserted into documents or opened with a multitude of software applications. Save the map as an image by clicking on the **Save as Image** button in the Maps toolbar.

Note: The Epi Info™ software will not open or edit a map saved in image format.

1. Click the **Save as Image** button. A **Save As** dialog box appears.

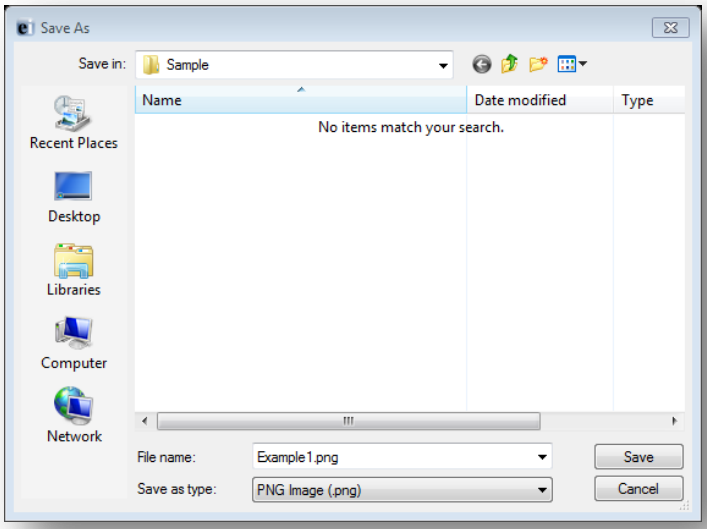

Figure 10.12: Save As dialog box

2. Create a **File name** and choose a file destination from the **Save in** drop-down list. The map is saved in the *.png file format, which can be opened later with an image software application.
3. Click the **Save** button. A Save Successful dialog box appears.
4. Click **OK** to exit.

Open Maps

The Epi Info™ Maps tool will only open files in the Maps (*.map7) file format. To open a maps file, click the **Open** button in the Maps toolbar and select the desired file.

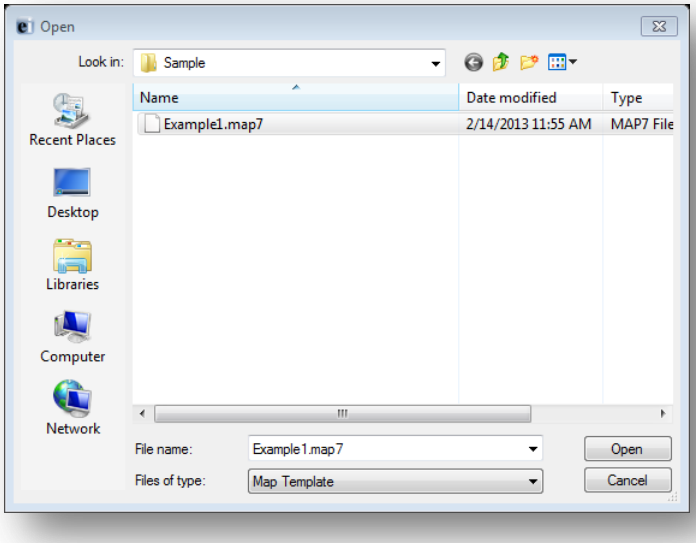

Figure 10.13: Open Map file dialog box

Click **Open**. The map file updates and displays in the main map window.

Adding a Data Layer

Case Clusters

Case Clusters display case locations on a map based on geographic coordinates. Each dataset used to create a case cluster must contain numeric fields that Maps can designate as latitude and longitude. The software has the capability of geocoding a street address into these coordinates. In cases where geocoding is not applied, a street address alone will not be sufficient to create a case cluster. For additional information on geocoding, refer to the Form Designer section of this user guide.

In the main map window, large clusters appear as bigger circles with the total case count contained inside of them. Individual cases appear as single dots without a case count designation. The example below demonstrates how to create a case cluster map in street view with the data included in the E. coli project folder.

1. Select **Add Data Layer** from the navigation menu.
2. Select **Case Cluster** from the drop-down list.

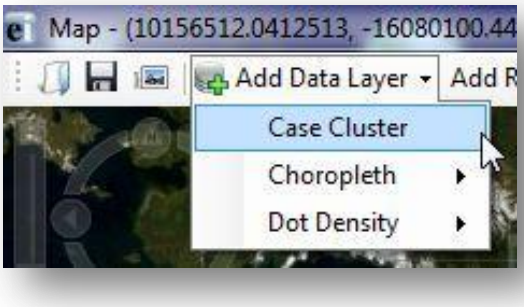

Figure 10.14: Case Cluster Data Layer

3. The **Data Source** dialog box appears.

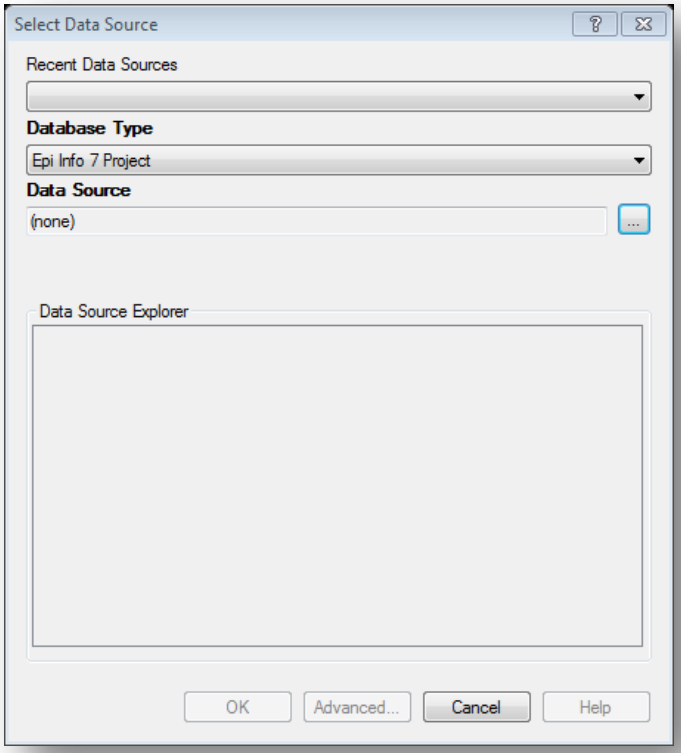

Figure 10.15: Select Data Source Dialog Box

4. Select the appropriate database from the **Database Type** drop-down list. There are multiple databases available from the drop-down list and it is imperative that the database type matches the file format that you are adding to Maps. For this demonstration, the default Epi Info 7 Project option is used.

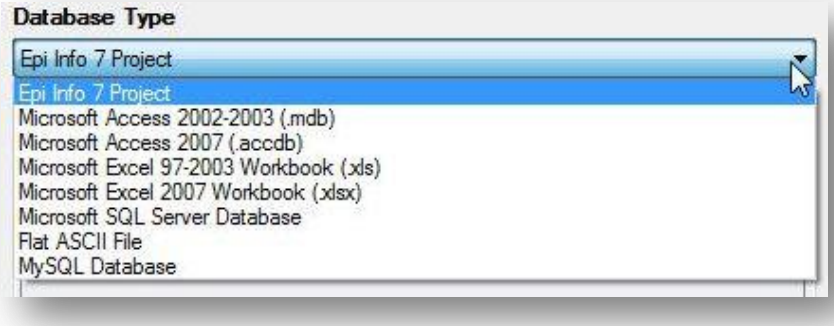

Figure 10.16: Database Type

5. Click on the **ellipses** next to the Data Source field.
6. Select the project data that you would like to map. For this demonstration, select the **Ecoli project**.
7. Select the **Food History** form from the Data Source Explorer menu. Click **OK**.

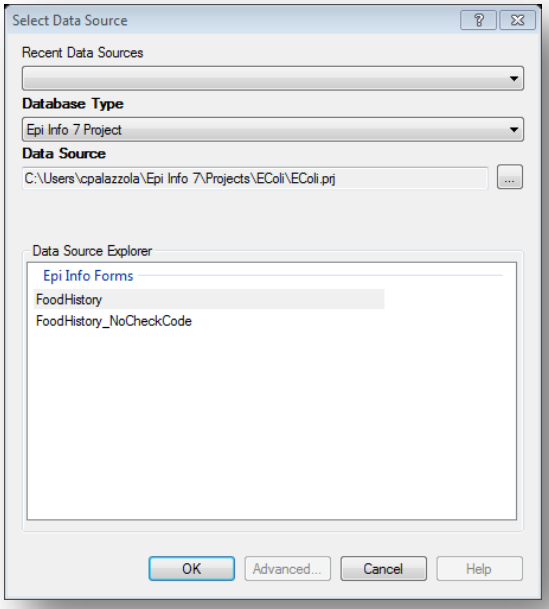

Figure 10.17: Data Source Explorer dialog box

8. Select the field containing the Latitude coordinates (**Latitude)** from the Latitude drop-down list.
9. Select the field containing the Longitude coordinates (**Longitude)** from the Longitude drop-down list.

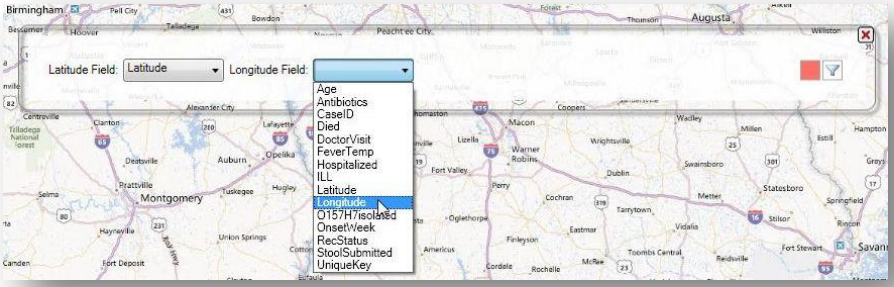

Figure 10.18: Latitude and Longitude drop-down list

10. The Maps tool will display all clusters based on latitude and longitude coordinates in red by default. You can change the color by clicking the red **Point Color** button and selecting a different color.

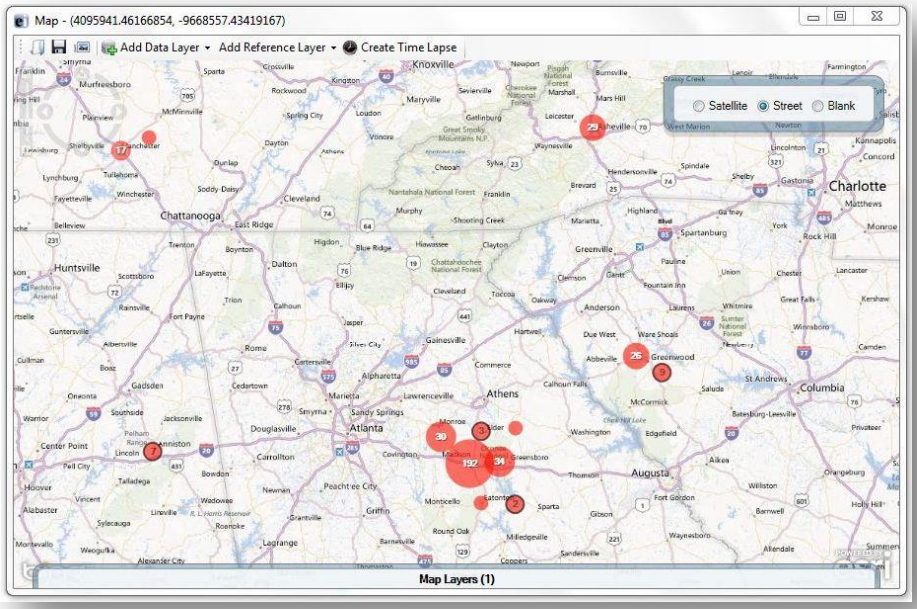

Figure 10.19: Case cluster map of E. coli cases

As the view zooms in, case clusters separate into smaller clusters and individual cases appear as single red dots.

Move the mouse over a small case cluster (less than 12 records) to flare the cluster outwards.

Figure 10.20: Expanded case cluster

The number six at the center of the cluster represents six different cases. When the mouse is over the case cluster, six smaller dots appear, each representing one of the six records inside of that cluster. This is useful if the same household contains multiple cases.

Data Filtering in Maps

Data filters in the Maps tool are used to select a subset of data by specifying and applying certain conditions. This allows the user to show the effect of a variable on the geographic distribution of cases. To access the data filter tool, move your cursor over the **Map Layers**

gadget at the bottom of the main map window. Currently there is one case cluster layer in red with no filters.

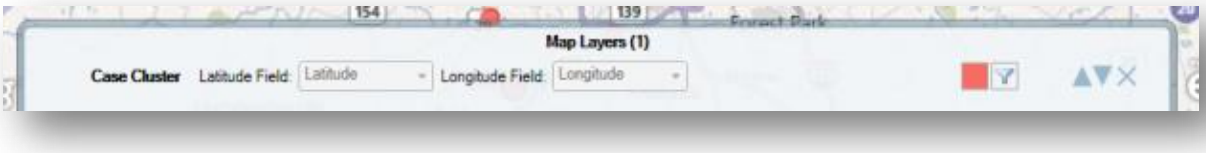

Figure 10.21: Map Layers gadget

The following example demonstrates how to apply a filter to the **Age** variable from the data layer added in the previous example.

1. Click the **Data Filters** button. The Data Filters gadget appears.

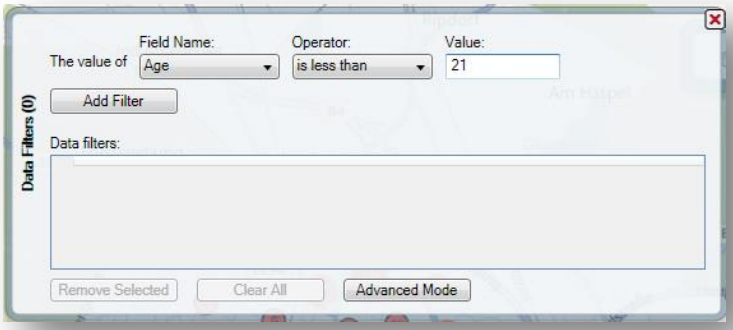

Figure 10.22: Data Filters dialog box

2. From the **Field Name** drop-down list, select **Age**.
3. From the **Operator** drop-down list, select **Is Less Than**.
4. Enter **21** into the **Value** textbox.
5. Click the **Add Filter** button. The **Data Filter** gadget displays one row in the Data filters table.

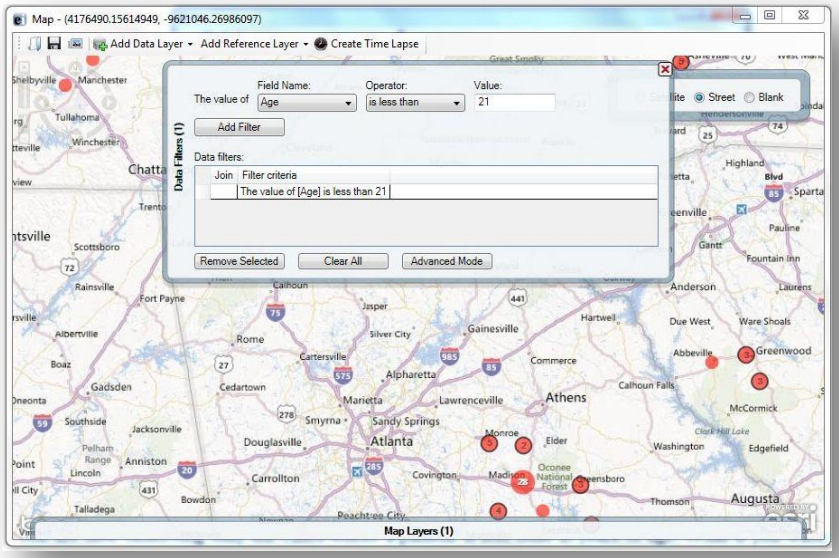

Figure 10.23: Map window with Data Filter

6. To close the gadget, click the **X** button. The map displays only cases where the patient's age is less than 21.

Stratifying Data

Filters are a powerful tool but in certain instances, it is best to display the full dataset in groupings. This requires stratifying the data. After completing the previous steps, the map displays the patient population that is less than 21 years of age. To create the stratified map, another layer is required to show an additional age group in the patient population. In the following example, a filter is applied to an additional layer based on the patient's age. Blue clusters will represent the records that meet the specified condition.

1. From the toolbar at the top of the map window, select **Add Data Layer > Case Cluster**.
2. Select the **Food History** form in the E. coli project. A small gadget appears with Latitude and Longitude drop-down lists.
3. Before selecting Latitude and Longitude, click the red **Point Color** button to change the layer's color to blue.

Figure 10.24: Point Color Menu

4. Click the **Data Filters** button. The Data Filters gadget appears. From the **Field Name** drop-down list, select **Age**.
5. From the **Operator** drop-down list, select **Is Greater Than or Equal To**.
6. Enter **21** into the **Value** textbox.
7. Click the **Add Filter** button.

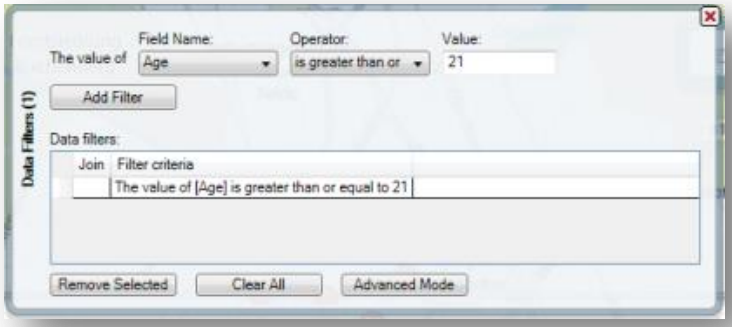

Figure 10.25: Stratified Data Filters gadget

8. To close the Data Filters gadget, click the **X** in the top-right corner.
9. From the **Latitude** drop-down list, select **Latitude**.
10. From the **Longitude** drop-down list, select **Longitude**. The stratified map displays both age groups by color.

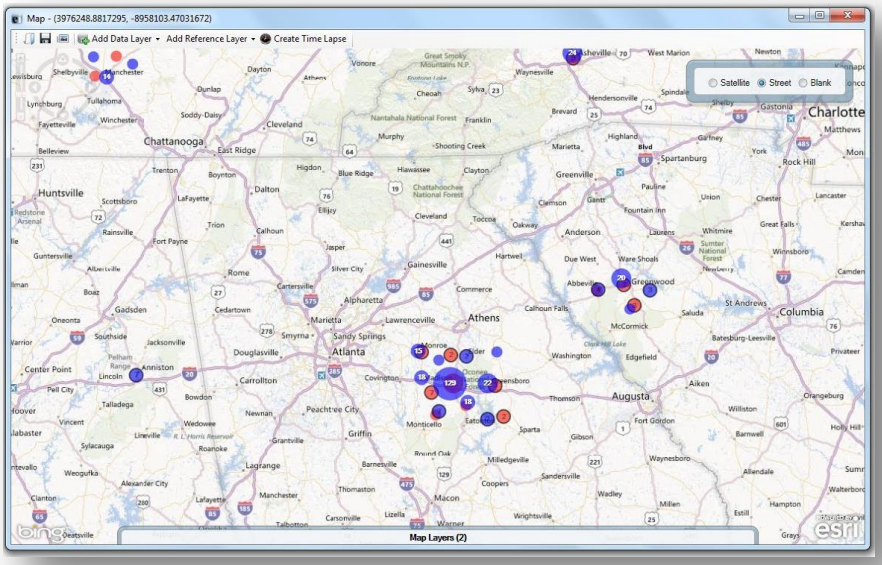

Figure 10.26: Stratified Map window

The blue clusters represent cases where the patient is 21 years of age or older, while the red clusters represent cases where the patient is less than 21. The Maps tool allows for multiple age groupings and can also stratify the dataset based on other variables (e.g., whether the patient is male or female, foods eaten, etc.).

Note that the Map Layers gadget at the bottom of the screen displays a (2) instead of a (1). This indicates that there are two different layers with corresponding filters.

Time Lapse

When a case cluster layer is added to Maps, the tool displays all cases contained in the dataset (If a filter is applied, Maps will display all cases that meet the selected filter criteria). The Time Lapse tool creates a dynamic environment to show how the dataset transforms over time. To enable this feature, load a data layer with a time variable.

1. Add a **Case Cluster** data layer (See Adding a Data Layer). Use the Food History form in the E. coli project for the following example.
2. Click **Create Time Lapse.**

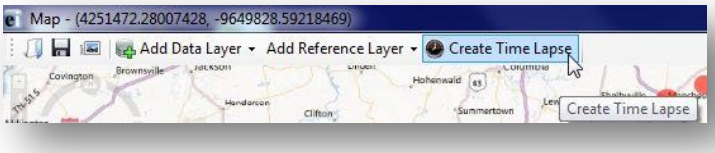

Figure 10.27: Create Time Lapse

3. Select the **OnsetDate** from the **Time Variable** from the drop-down list. Click **OK**.

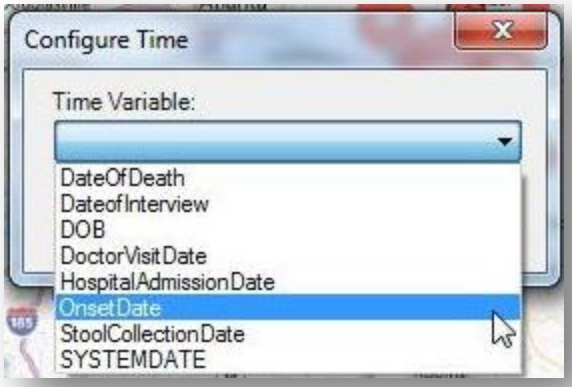

Figure 10.28: Configure Time dialog box

4. To show the progression of the symptom onset date over time, click the **Run** button to the left of the timeline.

Figure 10.29: Timeline

5. The main map window clears and begins adding the cumulative number of cases in accordance with the timeline. The figure below displays the number of cases in the dataset from 4/19/2011 to 5/17/2011.

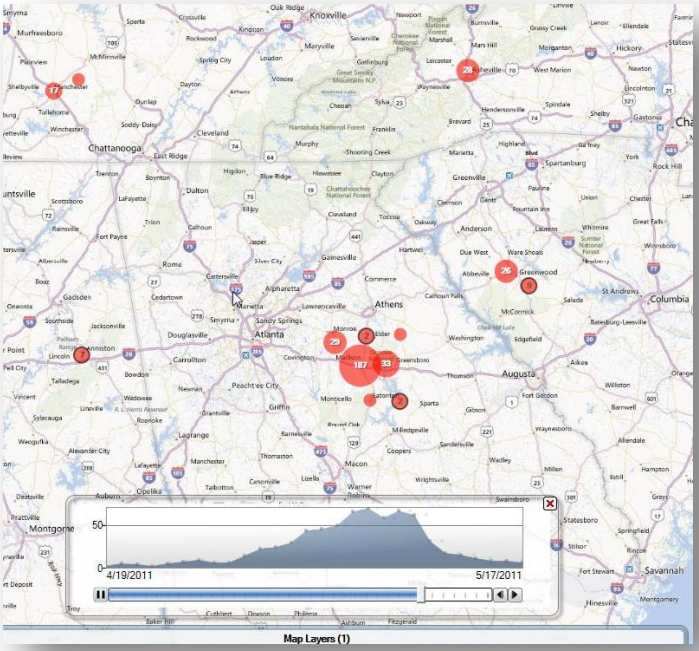

Figure 10.30: Time Lapse display

6. It is important to note that the distribution of cases displays at the bottom of the screen. At any time, press pause to show the cumulative dataset at that time interval. The buttons to the right of the timeline move the time series forwards and backwards.

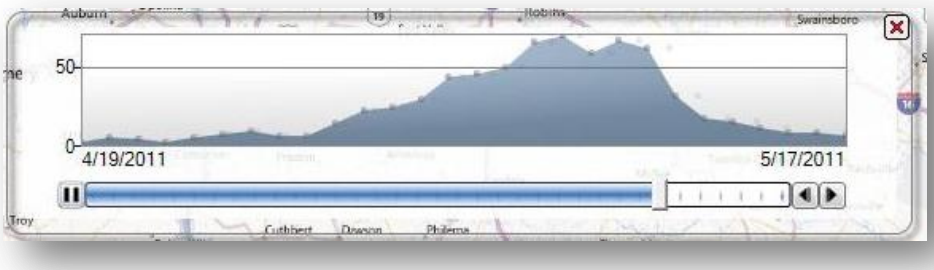

Figure 10.31: Time Series Distribution

Creating Choropleth and Dot Density Maps with Boundaries

Maps can create a choropleth or dot density map by combining a dataset with three boundary formats: shape file, map server, or KML (Keyhole Markup Language). See below for map/boundary format compatibility:

- Choropleth: Shape file
- Choropleth: Map server

- Choropleth: KML
- Dot density: Shape file
- Dot density: Map server
- Dot density: KML

The boundaries are independent of the dataset but are joined with database keys.

Note: The dataset and boundary file must contain the proper database keys and the user must designate the proper key from each drop-down list to create a choropleth or dot density map.

Key descriptions are as follows:

- **Feature Key** – designates the variable in the boundary set that will match a corresponding variable in the dataset.
- **Data Key** – designates the variable in the dataset that will match a corresponding variable in the boundary set.
- **Value Field** – designates the value being displayed.

Shape Files

A shape file stores non-topological geometric and spatial information in vector format. These files are simple to use but lack complex data elements. Various sources attach additional information or tables to shape files for more advanced analysis.

KML

KML is an open source specification for describing geographic data. Like shape files, KML files contain instructions used by mapping tools to draw boundaries, points, and other feature sets. A benefit to using KML files is that they can be edited using simple text editors.

Map Servers

Map server is a platform used to publish spatial and geographic data to the internet. One advantage of the map server format is the capability of creating a central repository for mapping data with relational database management systems.

Choropleth Map using Map Server Boundaries

A choropleth map uses graded differences in shading or color to display variations of a variable across a geographic area. The color gradient typically spans from one color to another or from light to dark.

The example below demonstrates how to combine a map server feature set for the state of New York with the Lyme data set included with Epi Info to create a choropleth map.

Note: This example uses case based data, where each row in the data set represents an individual case, rather than aggregate data.

1. Select **Add Data Layer** from the navigation menu.
2. Select **Choropleth>With Map Server Boundaries** from the drop-down list.

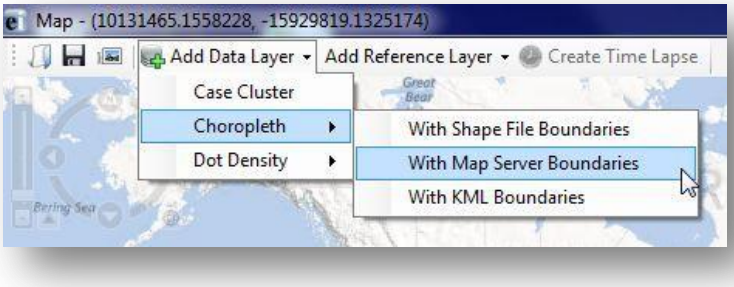

Figure 10.32: Choropleth using Map Server Boundaries

3. The Data Source dialog box appears. Select **Database Type** from the drop-down list.
4. Click on the **ellipses** next to the Data Source field. Select the Lyme project from the Epi Info™ 7 Projects folder.
5. Select the **Case Report** form. Click **OK**.

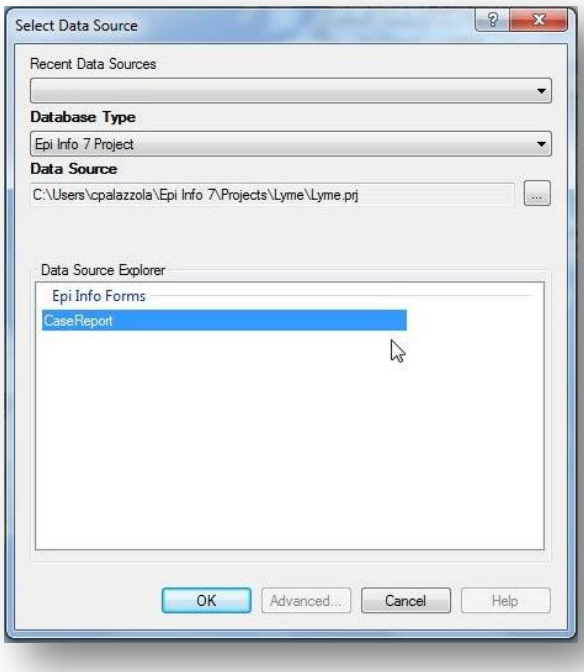

Figure 10.33: Choropleth Data Source dialog box

6. Click on the **Browse Map Server** button.

Figure 10.34: Browse Map Server

7. Select **NationalMap.gov – New York County Boundaries** from the drop-down list. Click **OK**.

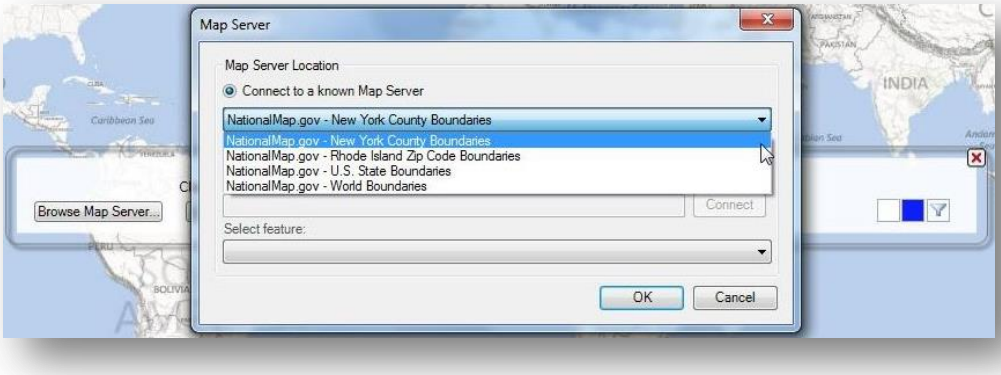

Figure 10.35: Map Server Location

8. The New York county boundaries appear on the map.
9. Select the number of **Classes** you want to display. By clicking on **four** from the drop-down list, the choropleth will designate values into quartiles.

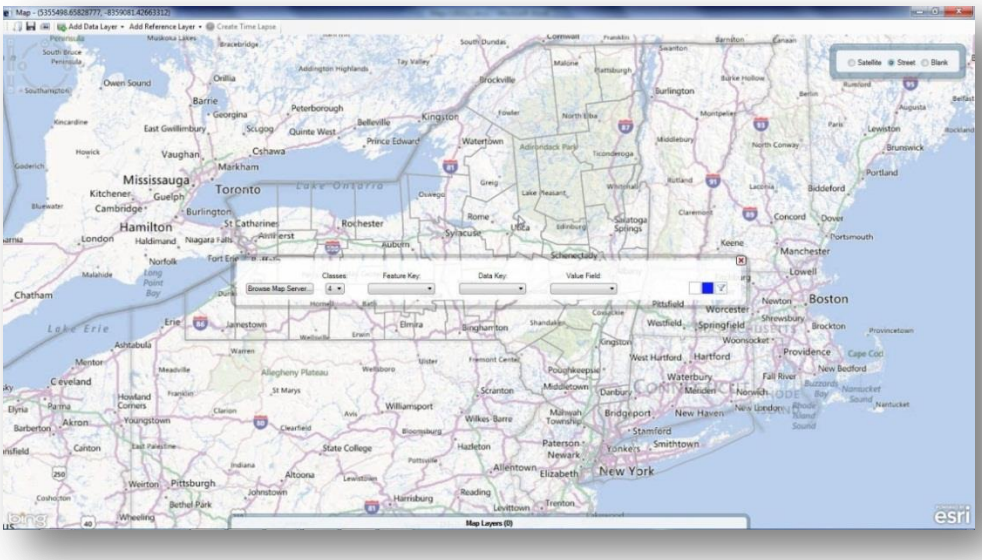

Figure 10.36: Map Server Boundaries

10. Select **COUNTY_NAME** from the **Feature Key** drop-down list. The feature key connects County_Names in the map server file to the dataset.

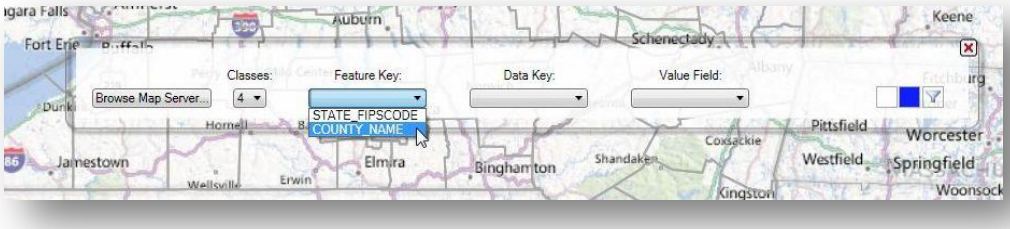

Figure 10.37: Map Server Feature Key

11. Select **County** from the **Data Key** drop-down list. The data key connects the dataset field, County, to the map server feature key COUNTY_NAME.

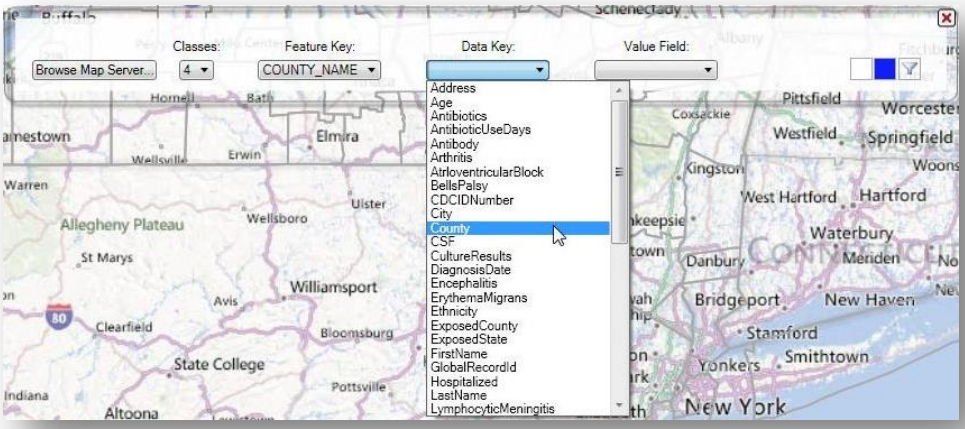

Figure 10.38: Map Server Data Key

12. Select **<Record Count>** from the **Value Field** drop-down list. Record Count is a system variable that provides the totals for the number of records in each boundary. This action will populate the choropleth based on the record count value.

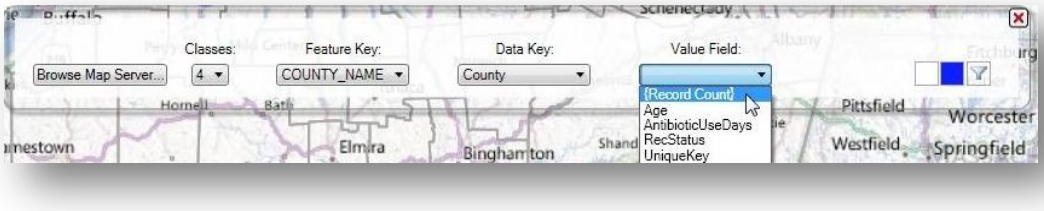

Figure 10.39: Map Server Value Field

The choropleth map appears showing the number of records in each New York County. Counties with the highest tier of records are dark blue while Counties containing the least amount of records are white.

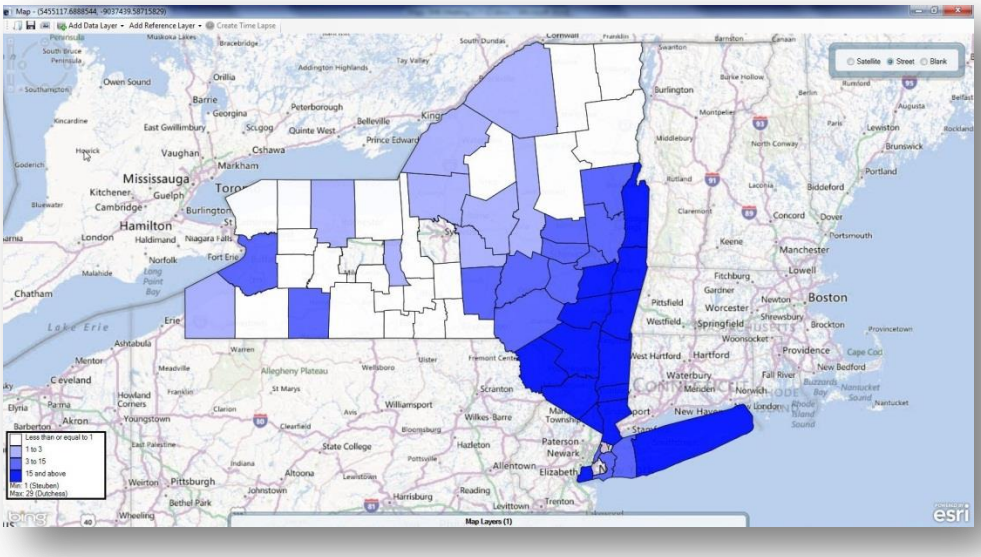

Figure 10.40: Choropleth in Street view

13. Select **Blank** view to display the choropleth with a white background.

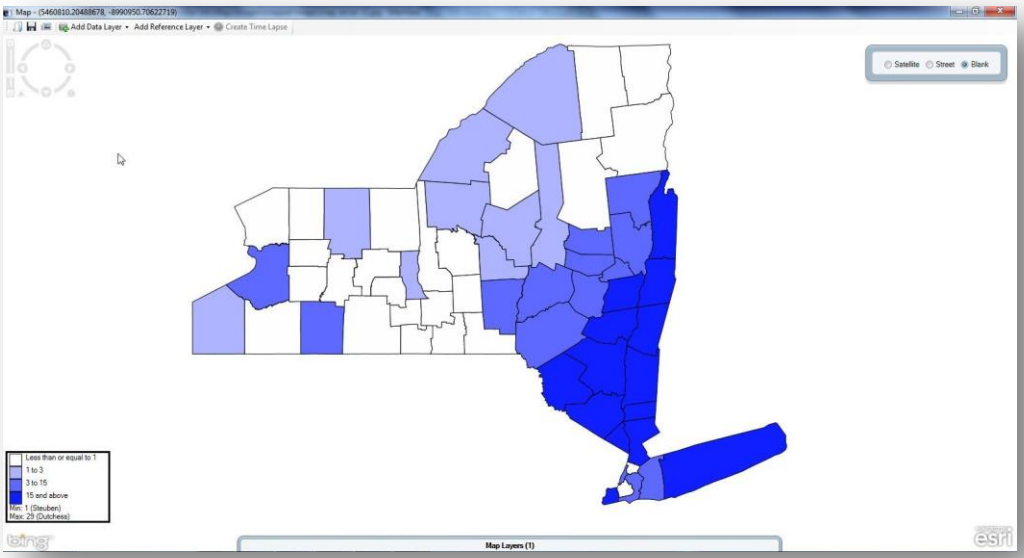

Figure 10.41: Choropleth in Blank view

14. To edit the color scheme or to add a filter, place the mouse over the Map Layers gadget located at the bottom of the screen.

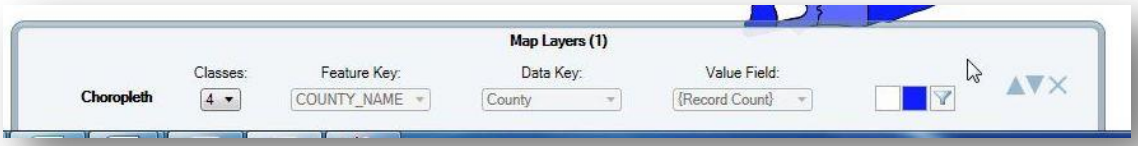

Figure 10.42: Map Layers Tab

Choropleth Map using KML Boundaries

The following demonstration uses aggregate data extracted from the 2011 U.S. Census' American Community Survey to show the percentage of the population lacking health insurance in counties in Maryland.

Note: This example uses aggregate data, which lists each geographic area once and contains a column for the aggregate value.

1. Select **Add Data Layer** from the navigation menu.
2. Select **Choropleth>With KML Boundaries** from the drop-down list.

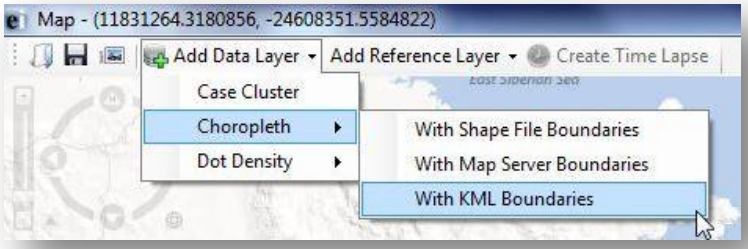

Figure 10.43: Choropleth using KML Boundaries

3. The **Data Source** dialog box appears. Select **Microsoft Excel 97-2003 Workbook** from the **Database Type** drop-down list.

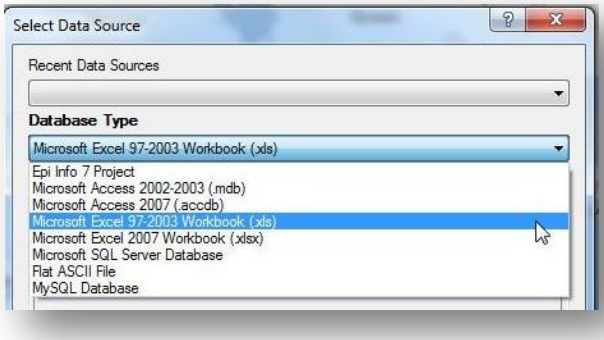

Figure 10.44: Database Type drop-down list

4. Click the **ellipses** next to the Data Source field. The **Open Existing File** dialog box appears.
5. Click the **ellipses** next to the **Location** textbox to browse for the KML file you would like to map. Select the **KML_Example** project.

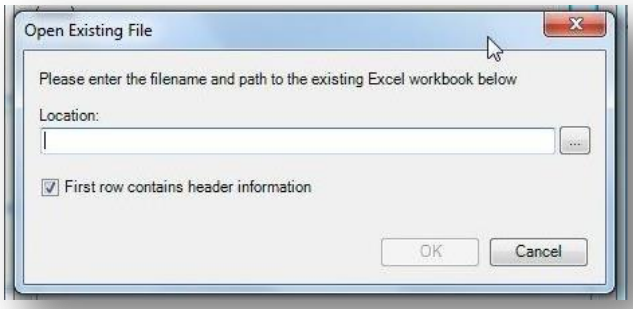

Figure 10.45: Open Existing File dialog box

6. Select **ACS_11_1YR_HealthInsurance**. Click **Open**.
7. Select the **Pct Uninsured by County$** Form. Click **OK**.

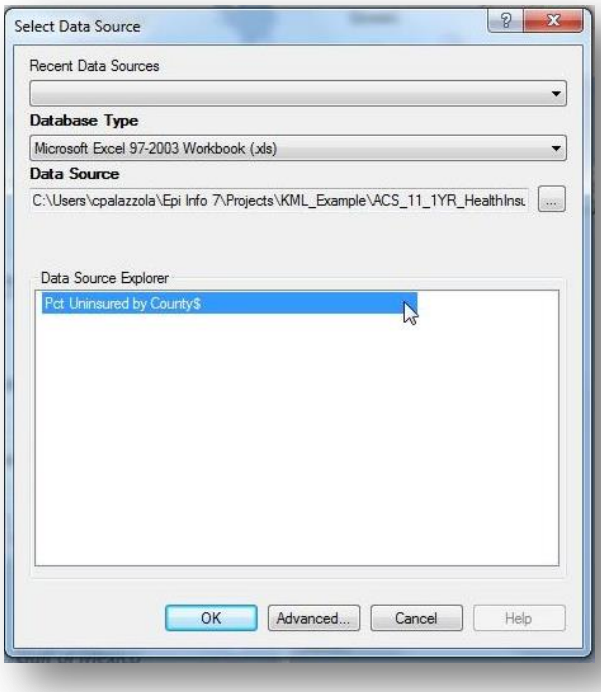

Figure 10.46: Choropleth Data Source dialog box

8. Click the **Specify KML** button.

Figure 10.47: Specify KML

9. Click the **Browse** button and select the **Maryland_Counties.kml** file under the KML_Example project folder. Click **OK**.

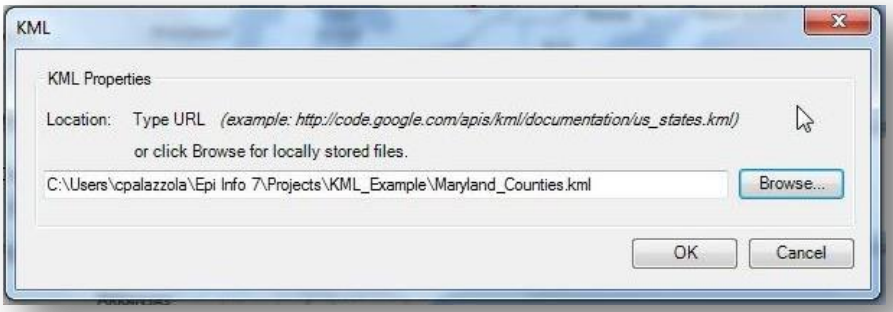

Figure 10.48: KML Location

10. A blank Maryland state map appears.
11. Select the number of **Classes** you want to display. By clicking on **four** from the drop-down list, the choropleth will designate values into quartiles.

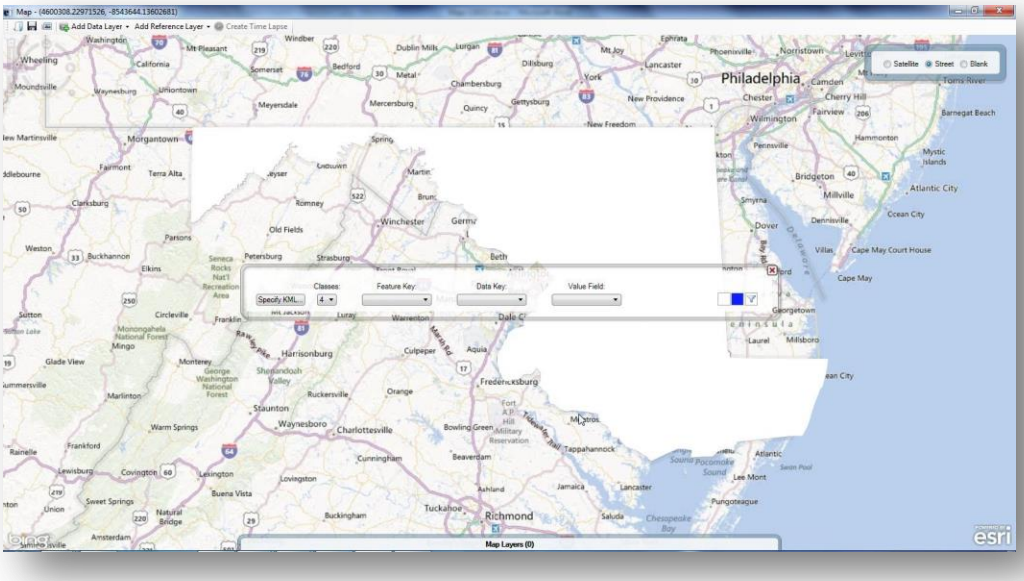

Figure 10.49: KML Boundaries

12. Select **County_Code** from the **Feature Key** drop-down list. The feature key connects County_Code in the KML file to the dataset.

Figure 10.50: KML Feature Key

13. Select **Geo#id2** from the **Data Key** drop-down list. The data key connects the dataset field, Geo#id2, to the KML feature key County_Code.

Figure 10.51: KML Data Key

14. Select **Estimate** from the **Value Field** drop-down list. This action will populate the choropleth based on the Estimate value.

Figure 10.52: KML Value Field

The choropleth map appears showing the estimated percentage of the population lacking health insurance in each Maryland County.

Note: Territories that do not contain any data will remain uncolored.

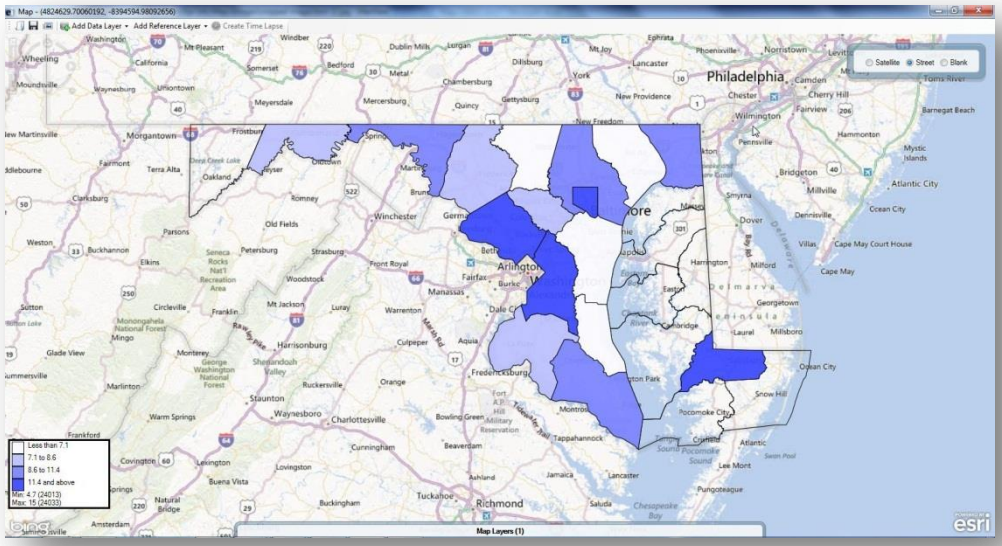

Figure 10.53: Choropleth in Street view

15. Select **Blank** view to display the choropleth with a white background.

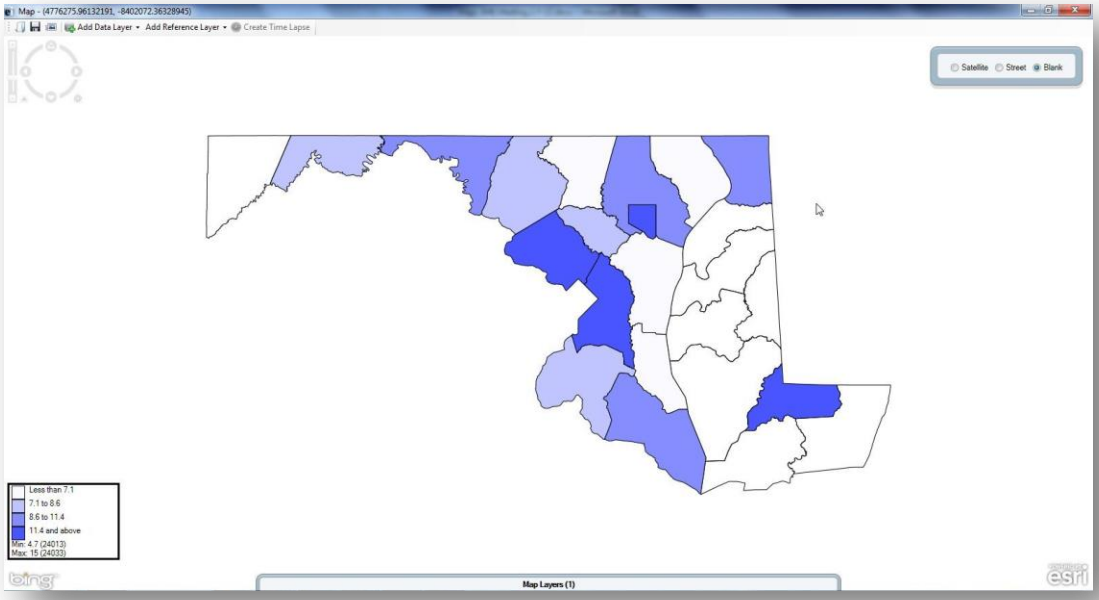

Figure 10.54: Choropleth in Blank view

16. To edit the color scheme or to add a filter, place the mouse over the Map Layers gadget located at the bottom of the screen.

Dot Density Map using Shape File Boundaries

To display densities across geographic boundaries, select **Dot Density** from the data layers drop-down list. Maps will populate the dot density map according to the dot value selected in step eight. Increasing the dot value increases the value each dot represents. The dot density map populates each dot randomly within a set of boundaries to display the density. The example below demonstrates how to create a dot density map with data from a Vital Statistics report published by the Mexico Ministry of Health using a shape file.

1. Select **Add Data Layer** from the navigation menu.
2. Select **Dot Density>With Shape File Boundaries** from the drop-down list.

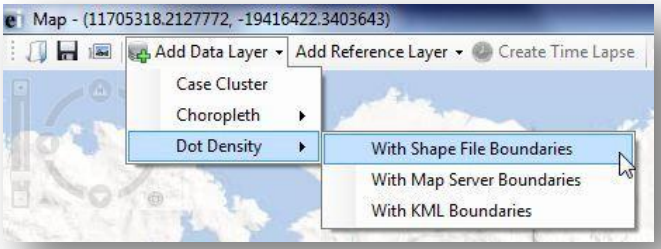

Figure 10.55: Dot Density with Shape File Boundaries

3. The **Data Source** dialog box appears. Select **Database Type** from the drop-down list.
4. Click on the **ellipses** next to the Data Source field. Select the project data that you would like to map. The following demonstration uses the Sample project.
5. Select the **MexMap95** form. Click **OK**.

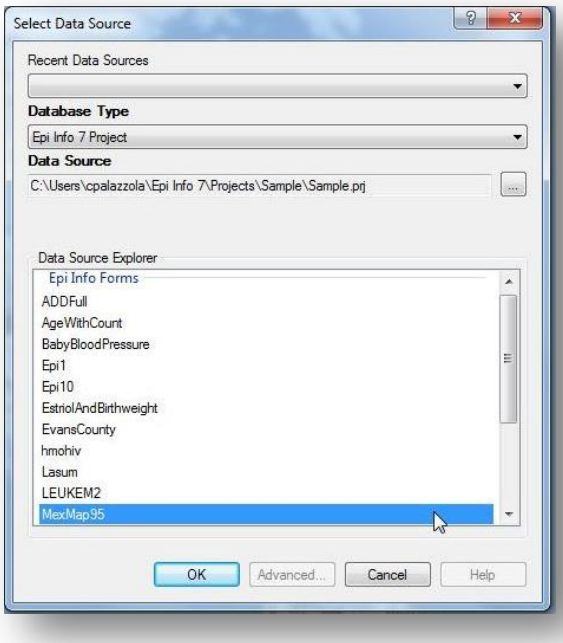

Figure 10.56: Shape File Data Source dialog box

6. Click the **Browse Shape File** button.

Figure 10.57: Browse Shape File

7. Select **MXState.shp** under the Sample project folder. The MexMap95 shape file boundaries appear on the map.
8. Enter the amount, as an integer, that each dot should count for under **Dot Value**. In this example, the dots are associated with the percentage of teen pregnancy in each state. By specifying "1", each dot will represent a single teen birth percentage point.

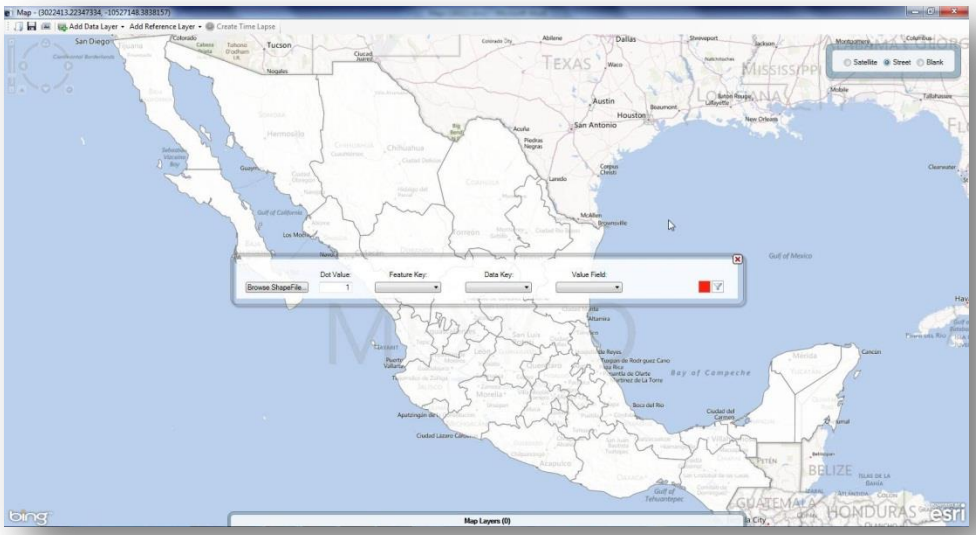

Figure 10.58: Shape File boundaries

9. Select **name** from the **Feature Key** drop-down list. The feature key connects name in the shape file to the dataset.

Figure 10.59: Shape File Feature Key

10. Select **STATE** from the **Data Key** drop-down list. The data key connects the dataset field, STATE, to the shape file feature key name.

Figure 10.60: Shape File Data Key

11. Select **PerTeenBirths95** from the **Value Field** drop-down list. This populates the dot density map based on the percentage of teen births in that state.

Figure 10.61: Shape File Value Field

Since one was selected as the dot value, each red dot that appears represents a single percentage point. Areas with a higher concentration of red dots represent a higher percentage of teen births.

Figure 10.62: Dot Density Map in Street View

12. Select **Blank** view to display the dot density map with a white background.

Figure 10.63: Dot Density in Blank View

13. To edit the color scheme or add a filter, place the mouse over the Map Layers gadget located at the bottom of the screen.

The three examples shown in the Adding a Data Layer section do not represent every possible combination of map type, database type and boundary file. The Epi Info™ Maps tool is capable of mapping all combinations using similar processes.

Reference Layer

Reference layers are available to enhance the map with additional information outside of the project data. In the previous section, you combined information from shape files, KML files, and the map server with your dataset to create choropleth and dot density maps. However, additional layers may be necessary to highlight points of interest or boundaries that are not evident in the data layers.

Map Server

1. From the toolbar at the top of the Map window, select **Add Reference Layer > Map Server**. The **Map Server** dialog box appears.

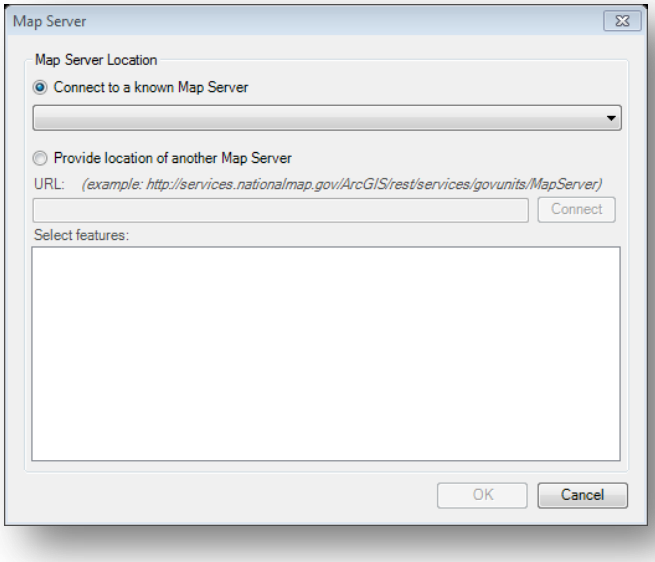

Figure 10.64: Map Server Location dialog box

2. Select the desired reference layer from the **Connect to a known Map Server** drop-down list or **Provide the location of another Map Server**. For this example, select **USGS.gov (National Hazards Support System) – Current Earthquakes** from the drop-down list. Click **OK**.

3. The map displays the location of all current earthquakes tracked in USGS' map server.

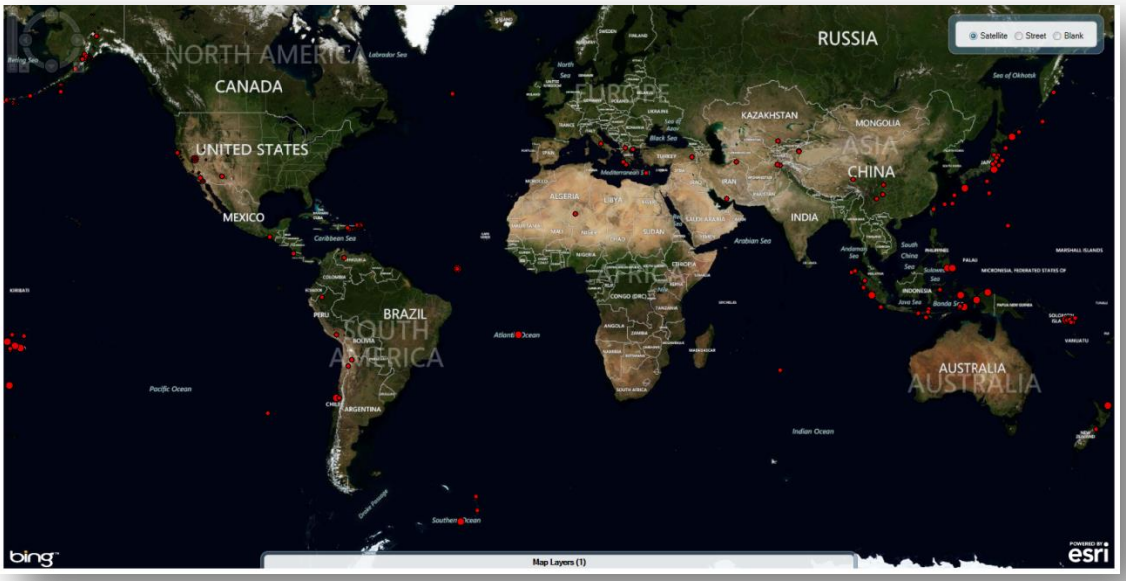

Figure 10.65: Map Server Reference Layer

Shape Files

The example below displays the Mexican state boundaries from the Sample project folder.

1. From the toolbar at the top of the map window, select **Add Reference Layer > Shape Files**.
2. Browse and select the desired shape file document, **Sample>MXState.shp**. The map appears displaying the shape file boundaries.

Figure 10.66: Shape file Reference Layer

KML

The example below displays the storm track taken by Hurricane Katrina.

1. From the toolbar at the top of the Map window, select **Add Reference Layer > KML**.
2. Type the following URL for NOAA's Katrina tracker: http://ngs.woc.noaa.gov/storms/katrina/kml/katrina_track.kml. The map appears displaying Hurricane Katrina's track.

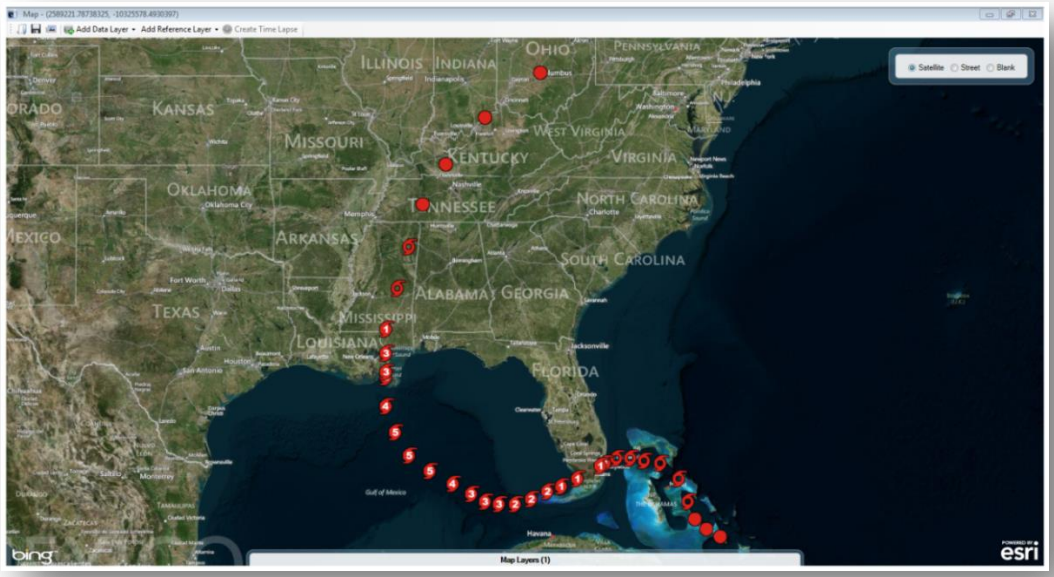

Figure 10.67: KML Reference Layer